

BEFORE THE  
FEDERAL COMMUNICATIONS COMMISSION  
WASHINGTON, DC 20554

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FILE

JAN 23 1989

Federal Communications Commission  
Office of the Secretary

In the Matter of )  
)  
Advanced Television Systems )  
and Their Impact on the Existing )  
Television Broadcast Service )  
)  
Review of Technical and )  
Operational Requirements: )  
Part 73-E, Television Broadcast )  
Stations )  
)  
Reevaluation of the UHF Television )  
Channel and Distance Separation )  
Requirements of Part 73 of the )  
Commission's Rules )

MM Docket No. 87-268

REPLY COMMENTS OF THE  
MOBILE COMMUNICATIONS DIVISION  
OF THE  
TELECOMMUNICATIONS INDUSTRY ASSOCIATION  
IN RESPONSE TO  
TENTATIVE DECISION AND  
FURTHER NOTICE OF INQUIRY

The Mobile Communications Division, of the Telecommunications Industry Association (hereinafter the Division)<sup>1</sup> is pleased to submit these reply comments in response to the above-captioned proceeding.

<sup>1</sup> The Telecommunications Industry Association (TIA) is a full service national trade organization with nearly 600 members which provide materials, products, systems, distribution services and professional services to the telecommunications industry in the United States and countries around the world. TIA represents the telecommunications industry in association with EIA.

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## EXECUTIVE SUMMARY

- o The spectrum use options presented herein provide a basis to permit timely selection of a spectrally efficient ATV approach, while also accommodating the immediate needs of mobile services.
- o The four options are:
  - ATV within existing NTSC channels in conjunction with mobile sharing --
    - This option permits ATV to be implemented with no spectrum ramifications, and Docket 85-172 sharing to move forward immediately.
  - ATV within existing NTSC channels in conjunction with television spectrum repack/reallocation --- By repacking the UHF television band upward, 96 MHz of spectrum could be reallocated for mobile use.
  - A simulcast ATV approach of the type proposed by Zenith in conjunction with mobile sharing --- All television stations can be assigned an additional 6 MHz for simulcast and Docket 85-172 land mobile sharing can be implemented now. Additionally, 168 MHz of spectrum would be available for reallocation when NTSC television is ultimately phased out.
  - A simulcast ATV approach with television spectrum repack/reallocation --
    - By downward repacking of the UHF television band, 48 MHz of spectrum could be reallocated for mobile needs. All television stations could have an additional 6 MHz for simulcast operation. Ultimately, 174 MHz of spectrum could be reallocated for other use when NTSC television is phased out.

## INTRODUCTION

In its Comments, the Division indicated that the Commission must act expeditiously to accommodate the immediate spectrum needs of cellular mobile, private land mobile, and cordless telephone users. These needs exist, even though: cellular mobile, although still in its infancy as a service, is expected to achieve a 3 or 4:1 improvement in spectrum efficiency in the near-term; private land mobile has already achieved a spectrum efficiency improvement of 10:1 since inception of the service, and more is expected; and cordless phones by virtue of intensive reuse, are among the most efficient users of the spectrum.

The Division further stated that the Commission has an opportunity in this proceeding to achieve a "win-win". Specifically four options, two involving television spectrum repacking/reallocation and two involving sharing as proposed in Docket 85-172 were described. These options offer promise to accommodate the needs of both the mobile<sup>2</sup> users and television viewers.

In contrast to the Division's win-win view, specifically with regard to the television repack options, the Association of Maximum Service Telecasters, Inc. (MST) and the National Association of Broadcasters (NAB) show little optimism for these approaches.

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<sup>2</sup> For convenience, mobile, as used herein includes cellular mobile, private land mobile, and cordless phones, although the later is not normally considered a mobile service. Spectrum options involving Docket 85-172 apply only to private land mobile.

MST at page 12 in its Comments states: "...reassignment or "repacking" of the VHF and UHF spectrum appears to be unlikely to yield significant new ATV spectrum...", and "...The current NTSC allocation plan is in fact quite spectrally efficient.", and "Repacking the VHF and UHF spectrum using 6 MHz-wide channels would yield few additional channels."

NAB at page 4 in its comments states: "For example, the latest computer runs initiated by WP3 indicate that the purported advantages of "repacking" the existing NTSC allocations are very few, and would not open up a significant amount of new spectrum."

The results of the preliminary studies reported in our Comments did, we believe, show that significant amounts of new spectrum could be made available for reallocation by repacking the UHF television band. These Reply Comments will expand upon those studies, as well as the studies involving the Docket 85-172 sharing options.

## ATV OPERATION WITHIN EXISTING NTSC CHANNELS - 6 MHZ ATV

As discussed in our Comments, ATV approaches are now coming forth which offer potential for significant improvements in the spectral efficiency of television use. The simplest ATV approach from a spectrum perspective would be based on a system which operates within and in conjunction with the existing NTSC channels. Several ATV approaches, such as the Sarnoff Laboratories ACTV-1 System, have been proposed. Two spectrum use options could be implemented with 6 MHz ATV, and they should be fully explored.

### 6 MHz ATV/Mobile Sharing

As discussed in our Comments, this option permits full ATV accommodation of all television stations. Also, action to implement Docket 85-172 land mobile sharing could proceed now, providing the near-term relief that is necessary for this service.

### 6 MHz ATV with Repack/Reallocation to Mobile

A computer analysis was conducted involving 6 MHz ATV. In this analysis, the television spectrum is repacked, i.e. reassigned to use less total spectrum, permitting the vacated spectrum to be reallocated to mobile.

The analysis was focused upon the northeast corridor of the United States where television station density is the greatest, and thus presumably the most difficult to accommodate. Additional study was done to verify that a spectrum solution for the northeast corridor would likely indicate that the rest of the U.S. could also be reasonably accommodated.

The FCC data base of television stations was used in the analysis. However, Canadian and Mexican stations were not yet included. Further analysis incorporating these additional stations may result in somewhat reduced amounts of spectrum for sharing or reallocation as shown herein. However, it should be recognized that if Canadian and Mexican spacing to U.S. stations are based upon ATV rather than NTSC criteria, which we believe is a logical approach, the impact may be relatively minor.

The results of the analysis, which is more fully defined in Appendix 3, are as follows:

- o Television stations using channels 14-29 were reassigned higher channels. Table A3-2 lists the affected stations and replacement channels. This permits 96 MHz of spectrum to be reallocated for mobile use. This option involving upward repacking was analyzed because it places the reallocated spectrum in the vicinity of the existing Docket 18261 mobile sharing channels and permits television service to be fully and solely contained within its own spectrum (except, of course, for channel 37 allocated to radio astronomy).
- o It would also be possible to repack downward, freeing spectrum at the top of the UHF television band. This approach would result in somewhat less than the 96 MHz of freed-up spectrum however, because of the need to continue to accommodate the Docket 18261 land mobile operation. A further approach might be to repack from both the top and bottom of the television band for a total of 96 MHz. These approaches have not yet been fully analyzed.

- o The television taboos would have to be relaxed for the reassigned NTSC stations. Fortunately, as discussed in the Appendix 2, a recent announcement by Hitachi offers promise for solution of this matter.
- o Many of the existing television stations would have to be assigned new channels with this option. As discussed below, a relatively smaller number would require reassignment if only major cities were to be repacked and if initially only a limited number of channels were involved.

#### ATV REQUIRING MORE THAN 6 MHZ - SIMULCAST OR AUGMENTATION

An approach of the type proposed by Zenith was shown in our Comments to yield more intensive spectrum use by permitting either Docket 85-172 land mobile sharing or by repacking the television spectrum and reallocating the vacated spectrum for other uses. The following provides further detail on these options.

An approach such as that put forth by Philips, which uses only 3 MHz of additional spectrum to augment an existing NTSC channel, should also permit spectrum use improvement. We have not, however, developed data for this approach.

### ATV Simulcast/Mobile Sharing

An ATV system such as that proposed by Zenith requires a total of 12 MHz of spectrum for each station, 6 MHz for the existing NTSC operation and 6 MHz for simulcast ATV operation.

A computer analysis was conducted based on this system and related parameters to determine the potential spectrum ramifications of this approach. The procedures previously discussed were used to conduct the analysis. A detailed discussion is contained in Appendix 1.

The results of the analysis are as follows:

- o All television stations can be assigned an additional 6 MHz channel for simulcast.
- o The highest assigned simulcast channel is 41. This means that at some future time when NTSC is fully supplanted, 168 MHz of additional spectrum (channels 42-69) can be reallocated for other use.
- o The channels proposed by the Commission in Docket 85-172 for land mobile sharing can be allocated now.

Table A1-2 in Appendix 1 shows each television station along with its companion simulcast channel. Note that the purpose of this table is to illus-



trate that each station can, in fact, be successfully assigned a simulcast channel. The list is not necessarily optimum, and does not at this point constitute a specific recommendation with regard to any given television station.

#### ATV Simulcast with Repack/Reallocation to Mobile

Another analysis was conducted, again based on a system type such as that proposed by Zenith, to ascertain the spectrum ramifications if the top portion of the UHF television spectrum were to be repacked (i.e. reassigned) to lower spectrum. The same analysis procedures were used as previously described. See Appendix 2 for more detail.

The results of this analysis are as follows:

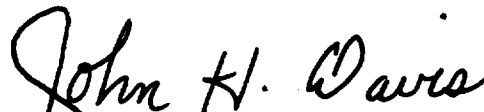
- o Television stations in channels 62-69 were reassigned lower channels. Table A2-1 list the affected stations and the replacement channels. This resulted in 48 MHz of spectrum for reallocation to mobile use.
- o All existing television stations can be assigned an additional 6 MHz for simulcast operation. Table A2-2 lists all stations along with the assigned simulcast channel. As previously discussed, this listing is meant to be illustrative of feasibility rather than a concrete recommendation.
- o All ATV channels are assigned to channel 40 or below. Therefore 174 MHz of spectrum (Channel 41-69) can be allocated to other uses when all NTSC stations are supplanted by ATV stations.

- o Figure A2-1 shows the number of television stations that presently occupy the higher channels. For the entire United States, 73 stations (plus, as described in the Appendix, an additional approximately 20 percent) would be affected if this plan were implemented. It is important to note, however, that such a repacking program would likely be done on an evolutionary basis, and if, for example, two television channels in the top three cities were to be initially reallocated, only five television stations would have to be reassigned.
  
- o As previously discussed the television taboos as applied to the reassigned NTSC channels must be considered.

#### CONCLUSIONS

The above-discussed four options continue to be attractive candidates as a solution to the immediate needs of mobile users as well as for spectrally efficient ATV. All interested parties are invited to seriously and expeditiously study and refine these options so that a suitable alternative can be chosen and appropriate regulatory action promulgated.

Respectfully submitted,



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DATE: January 23, 1989

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## APPENDIX 1

### INTRODUCTION

In this appendix, we will show that there is adequate spectrum within the existing VHF and UHF bands to provide every existing TV station 12 MHz of spectrum while providing for the existing land mobile - TV sharing allocated in Docket 18261 and additional sharing described in Docket 85-172. The 12 MHz for each TV station will be two 6 MHz blocks, one for transmitting a standard NTSC signal and one for transmitting an HDTV signal such as the Zenith Spectrum Compatible HDTV [1] which was described to the FCC's Advisory Committee on ATS.

This analysis will concentrate on the existing TV stations in the most dense area of the nation, the northeast corridor where specific channel assignments will be developed for all of these stations. Then, it will be shown that the density and geography of TV stations in the other heavily populated areas of the USA should not inhibit the assignment of the HDTV channels for them also.

### DATA BASE

The data base used in this analysis is the FCC data base of US, Canadian, and Mexican TV stations as of September 1987, which was obtained through NTIS. This data base was placed on a VAX cluster of 8700 computers. A modified data base was created which consists of all USA stations with a license, construction permit, or application granted that was in the original data base. Table A-1 shows the states on the northeast corridor which were included, and the number of TV stations in this modified data base. The exact coordinates of each of these stations were used in the analysis to follow. In cases where duplicate entries existed for the same call letters and channel number of a station, the choice of which to use was based on the date of entry and the evident intent of the station to finalize their parameters.

The same procedure was also followed for the rest of the USA culminating in a total of 1584 TV stations in the modified data base.

As a check, several of the stations on the northeast corridor were investigated to confirm the validity of the data base. Seven UHF stations were found which are not on the air in December, 1988. No stations were found on the air that were not in the data base. Thus, the use of this data base should produce results which may be somewhat conservative from that standpoint. Conversely, there are some stations near the Canadian border, and the effect of

treaties which limit use of certain channels was not taken into account. The most dense areas near Baltimore, MD and Miami, FL are not influenced by border effects, however, the impact of near border stations must be studied further.

#### ALGORITHM FOR CHANNEL ASSIGNMENT

The determination of the channels which a station could occupy was computerized in the following way. Spacing criteria for co-channel operation, was input into the program. Then the data base was scanned for the TV station under consideration and all channels 2 through 69 were tested to see if the spacing criteria were met. Each channel for which the criteria was met was placed in a candidate channel array.

Manual assignments are made from the candidate array which permit flexibility to optimize the assignment. Also, the computer is used in an "automatic mode" in which it assigns the lowest channel from the candidate array to the station having the least number of options and proceeds on to the next station.

The spacing between stations is the great circle distance between them as determined by their longitude and latitude in the data base. The great circle distance was determined by the formulas in [2] as implemented in a FORTRAN subroutine. All variables within the subroutine were set to double precision to maximize the accuracy of the technique.

The co-channel spacing criteria used for channels allocated for land mobile sharing in Docket 18261 is 212 miles, and for Docket 85-172 sharing the spacing is 160 miles. This difference reflects the 10 dB difference in co-channel Desired to Undersired ratio in the two dockets. No further requirements are dictated by the Zenith Spectrum Compatible HDTV.

The spacing criteria between HDTV to HDTV and HDTV to NTSC stations used to assign the 6 MHz HDTV channel to existing stations was taken from [3] based on D/U values developed by Zenith in [1]. The values used are low band VHF 78.9 miles, high band VHF 87.0 miles, UHF 67.7 miles.\*

\*These spacings are predicated on using a directive receiving antenna with front to back (and front to side) ratio to provide some immunity from co-channel interference.

# RESULTS OF ANALYSIS IN NORTHEAST CORRIDOR

Table A1-2 shows all of the TV stations in the northeast corridor, the NTSC channel and the HDTV channel which meet the spacing requirements above. The median spacing of the HDTV channel from any other channel is 89 miles. The maximum channel used for HDTV is channel 41. It was not necessary to use channels 42-69 in this case. The channels shown for HDTV are one set which meet the spacing requirements. Numerous options exist for each assignment which could be chosen with due respect for other stations in the area.

Thus, we conclude that all existing TV stations in the northeast corridor can be given an additional 6 MHz HDTV channel, and the proposed sharing in Docket 85-172 does not inhibit any existing TV stations from receiving this additional 6 MHz allocation.

## EXTENSION TO THE REST OF THE USA

In the northeast corridor there are two locations where the density of TV stations is maximized. We define the density to be that number of stations which fit within a circle whose diameter is the present co-channel spacing requirement. With the circle centered at a point about 5 miles northeast of Baltimore, MD, there are 48 stations within the circle, of diameter 155 miles, and with the circle centered about 75 miles west of Boston, MA, there are 46 stations.

In television zone 3 as defined in the FCC rules, the co-channel spacing requirement is 205 miles. There is an area centered near Miami where 48 stations can be located within a 205 mile diameter circle. Because the Florida peninsula is long and relatively narrow, it should be easier to assign channels in this area than in the northeast corridor. Table A-3 shows the major metropolitan areas studied, their zone, and the number of stations with the co-channel reuse diameter.

Therefore, we conclude that having shown that the northeast corridor can be accommodated, it is highly likely that it can be shown that the rest of the USA can be accommodated using the same techniques.

TABLE A1-1STATES AND NUMBER OF STATIONS IN THE  
NORTHEAST CORRIDOR DATA BASE

<u>LOCATION</u>	<u>NUMBER OF TV STATIONS</u>
Maine	15
Vermont	7
New Hampshire	9
Massachusetts	22
Connecticut	13
Rhode Island	5
New York	55
Pennsylvania	46
New Jersey	15
Delaware	3
Maryland	18
Washington DC	8
West Virginia	15
Virginia	38

TABLE A1-2

TELEVISION STATIONS ON THE NORTHEAST CORRIDOR WITH COMPUTED  
HIGH DEFINITION TV ASSIGNMENT. DOCKET 18261 LAND MOBILE  
ALLOCATIONS AND DOCKET 85-172 PROPOSED LAND MOBILE  
ALLOCATIONS ALSO INCLUDED.

CALL*	CH	HDCH	TOWN	STATE	CALL*	CH	HDCH	TOWN	STATE
WCBB	10	09	AUGUSTA	ME	WLBZTV	2	03	BANGOR	ME
WABITV	5	04	BANGOR	ME	WVIITV	7	06	BANGOR	ME
WMEATV	26	15	BIDDEFORD	ME	WMEDTV	13	10	CALAIS	ME
NU01	35	15	LEWISTON	ME	WMEBTV	12	11	ORONO	ME
WMTWTV	8	04	POLAND SPRING	ME	WCSHTV	6	05	PORTLAND	ME
WGMETV	13	12	PORTLAND	ME	WPXT	51	02	PORTLAND	ME
WAGMTV	8	02	PRESQUE ISLE	ME	WMENTV	10	09	PRESQUE ISLE	ME
NU02	62	03	PRESQUE ISLE	ME	WCAXTV	3	02	BURLINGTON	VT
WVNY	22	06	BURLINGTON	VT	WETK	33	07	BURLINGTON	VT
WNNETV	31	05	HARTFORD	VT	WVER	28	08	RUTLAND	VT
WVTB	20	09	ST. JOHNSBURY	VT	WVTA	41	17	WINDSOR	VT
WEDBTB	40	17	BERLIN	NH	WNHT	21	19	CONCORD	NH
WNDS	50	20	DERRY	NH	WENHTV	11	10	DURHAM	NH
WHEDTV	15	23	HANOVER	NH	WEKWTB	52	22	KEENE	NH
WLEDTV	49	18	LITTLETON	NH	WMURTV	9	18	MANCHESTER	NH
WGOT	60	24	MERRIMACK	NH	WCDC	19	04	ADAMS	MA
WGBHTV	2	03	BOSTON	MA	WBZTV	4	08	BOSTON	MA
WCVBTV	5	13	BOSTON	MA	WNEVTV	7	17	BOSTON	MA
LM01	14	NONE	BOSTON	MA	LM02	16	NONE	BOSTON	MA
WFXT	25	22	BOSTON	MA	WSBKTV	38	23	BOSTON	MA
WGBXTV	44	26	BOSTON	MA	WQTV	68	29	BOSTON	MA
WLVITV	56	31	CAMBRIDGE	MA	WLQF	32	28	GREENFIELD	MA
WMFP	62	32	LAWRENCE	MA	WHSB	66	33	MARLBOROUGH	MA
WLNE	6	09	NEW BEDFORD	MA	WFDG	28	20	NEW BEDFORD	MA
WRYT	46	24	NORWELL	MA	WVUW	51	07	PITTSFIELD	MA
WWLP	22	17	SPRINGFIELD	MA	WGGBTB	40	23	SPRINGFIELD	MA
WGBYTV	57	25	SPRINGFIELD	MA	WCVX	58	21	VINEYARD HAVE	MA
WHLL	27	30	WORCESTER	MA	WBCTTV	43	12	BRIDGEPORT	CT
WEDW	49	28	BRIDGEPORT	CT	WFSB	3	02	HARTFORD	CT
WHCTTV	18	06	HARTFORD	CT	WEDH	24	31	HARTFORD	CT
WTICTV	61	05	HARTFORD	CT	WVIT	30	35	NEW BRITAIN	CT
WTNH	8	10	NEW HAVEN	CT	WTVU	59	36	NEW HAVEN	CT
WEDY	65	38	NEW HAVEN	CT	WTWS	26	32	NEW LONDON	CT
WEDN	53	29	NORWICH	CT	WTKX	20	39	WATERBURY	CT
WOSTTV	69	21	BLOCK ISLAND	RI	WJAR	10	11	PROVIDENCE	RI
WPRITV	12	18	PROVIDENCE	RI	WSBETV	36	35	PROVIDENCE	RI
WNACTV	64	34	PROVIDENCE	RI	WTEN	10	09	ALBANY	NY
WNYT	13	12	ALBANY	NY	WXXATV	23	11	ALBANY	NY
WOCB	55	03	AMSTERDAM	NY	WBNGTV	12	13	BINGHAMTON	NY
WMGCTV	34	02	BINGHAMTON	NY	WICZTV	40	04	BINGHAMTON	NY
WSKGTB	46	07	BINGHAMTON	NY	WGRZTV	2	03	BUFFALO	NY
WIVBTV	4	05	BUFFALO	NY	WKBWTV	7	06	BUFFALO	NY
WNEDTV	17	09	BUFFALO	NY	WNEQTV	23	15	BUFFALO	NY
WUTV	29	16	BUFFALO	NY	WNYBTV	49	11	BUFFALO	NY
WVNYTV	7	08	CARTHAGE	NY	WETMTV	18	16	ELMIRA	NY



<u>CALL*</u>	<u>CH</u>	<u>HDCH</u>	<u>TOWN</u>	<u>STATE</u>	<u>CALL*</u>	<u>CH</u>	<u>HDCH</u>	<u>TOWN</u>	<u>STATE</u>
WENYTV	36	17	ELMIRA	NY	WLIW	21	18	GARDEN CITY	NY
NU03	52	21	ITHACA	NY	WNOD	26	08	JAMESTOWN	NY
WTZA	62	18	KINGSTON	NY	WCBSTV	2	03	NEW YORK	NY
WNBCTV	4	06	NEW YORK	NY	WNYW	5	22	NEW YORK	NY
WABCTV	7	23	NEW YORK	NY	WPIX	11	26	NEW YORK	NY
LM03	19P	NONE	NEW YORK	NY	WNYETV	25	39	NEW YORK	NY
LM04	27P	NONE	NEW YORK	NY	LM05	28P	NONE	NEW YORK	NY
WNYCTV	31	35	NEW YORK	NY	LM06	33P	NONE	NEW YORK	NY
LM07	34P	NONE	NEW YORK	NY	WPTZ	5	04	NORTH POLE	NY
WNPITV	18	02	NORWOOD	NY	WCFETV	57	09	PLATTSBURGH	NY
WTBY	54	21	POUGHKEEPSIE	NY	WLG	55	17	RIVERHEAD	NY
WROCTV	8	12	ROCHESTER	NY	WHECTV	10	14	ROCHESTER	NY
WOKR	13	15	ROCHESTER	NY	WXITV	21	16	ROCHESTER	NY
WUHF	31	17	ROCHESTER	NY	WRGB	6	05	SCHENECTADY	NY
WMHT	17	22	SCHENECTADY	NY	WMHX	45	24	SCHENECTADY	NY
WHSI	67	40	SMITHTOWN	NY	WSTMTV	3	06	SYRACUSE	NY
WTVH	5	11	SYRACUSE	NY	WIXT	9	17	SYRACUSE	NY
WCNYTV	24	18	SYRACUSE	NY	WSNRTV	43	19	SYRACUSE	NY
NU04	56	21	SYRACUSE	NY	WSYT	68	22	SYRACUSE	NY
WKTU	2	04	UTICA	NY	WUTR	20	23	UTICA	NY
WTUV	33	25	UTICA	NY	WNPETV	16	10	WATERTOWN	NY
WFYFTV	50	12	WATERTOWN	NY	WLVTTV	39	24	ALLENTOWN	PA
WFMZTV	69	25	ALLENTOWN	PA	WTAJTV	10	12	ALTOONA	PA
WWPCTV	23	15	ALTOONA	PA	WKBSTV	47	21	ALTOONA	PA
NU05	60	26	BETHLEHEM	PA	WPSXTV	3	02	CLEARFIELD	PA
WICUTV	12	11	ERIE	PA	WJETTV	24	02	ERIE	PA
WSEE	35	03	ERIE	PA	WQLN	54	09	ERIE	PA
WETG	66	10	ERIE	PA	WPCBTU	40	21	GREENSBURG	PA
WHPTV	21	05	HARRISBURG	PA	WHTMTV	27	06	HARRISBURG	PA
WITFTV	33	23	HARRISBURG	PA	WWLF	56	09	HAZLETON	PA
WJACTV	6	07	JOHNSTOWN	PA	WWCPTV	8	09	JOHNSTOWN	PA
WFATTV	19	25	JOHNSTOWN	PA	WGALTU	8	04	LANCASTER	PA
WLYHTV	15	35	LANCASTER	PA	WGGE	55	24	LEBANON	PA
KYWTU	3	02	PHILADELPHIA	PA	WPVITV	6	05	PHILADELPHIA	PA
WCAUTV	10	16	PHILADELPHIA	PA	WPHLTU	17	22	PHILADELPHIA	PA
LM08	19	NONE	PHILADELPHIA	PA	LM09	20	NONE	PHILADELPHIA	PA
WTAFTV	29	38	PHILADELPHIA	PA	WYBE	35	40	PHILADELPHIA	PA
LM12	42P	NONE	PHILADELPHIA	PA	LM13	46P	NONE	PHILADELPHIA	PA
WGBSTV	57	31	PHILADELPHIA	PA	KDKATV	2	03	PITTSBURGH	PA
WTAETV	4	05	PITTSBURGH	PA	WPXI	11	15	PITTSBURGH	PA
WQED	13	20	PITTSBURGH	PA	LM14	14	NONE	PITTSBURGH	PA
WQEX	16	23	PITTSBURGH	PA	LM15	18	NONE	PITTSBURGH	PA
WPTTTV	22	26	PITTSBURGH	PA	WPGHTV	53	28	PITTSBURGH	PA
WTVE	51	41	READING	PA	WGCBTU	49	16	RED LION	PA
WNEPTV	16	08	SCRANTON	PA	WYOU	22	11	SCRANTON	PA
WOLFTV	38	03	SCRANTON	PA	WVIATV	44	21	SCRANTON	PA
WXEK	29	04	STATE COLLEGE	PA	WBRETV	28	23	WILKES-BARRE	PA
WPMT	43	22	YORK	PA	WWACTV	53	13	ATLANTIC CITY	NJ
NU06	48	32	BURLINGTON	NJ	WNJS	23	41	CAMDEN	NJ
WNJUTV	47	36	LINDEN	NJ	WNJM	50	29	MONTCLAIR	NJ
WNJB	58	28	NEW BRUNSWICK	NJ	LM16	14	NONE	NEW YORK/NORT	NJ
LM17	15	NONE	NEW YORK/NORT	NJ	WNET	13	38	NEWARK	NJ
WHSE	68	30	NEWARK	NJ	WXTV	41	32	PATERSON	NJ

CALL*	CH	HDCH	TOWN	STATE	CALL*	CH	HDCH	TOWN	STATE
WWOR	9	24	SECAUCUS	NJ	WNJT	52	08	TRENTON	NJ
WLMR	59	07	VINELAND	NJ	WHSP	65	04	VINELAND	NJ
NU07	66	40	WEST MILFORD	NJ	WMGMTV	40	11	WILDWOOD	NJ
WDPB	64	08	SEAFORD	DE	WHYYTV	12	21	WILMINGTON	DE
WTGITV	61	09	WILMINGTON	DE	WMPT	22	25	ANNAPOLIS	MD
WMARTV	2	03	BALTIMORE	MD	WBALTV	11	21	BALTIMORE	MD
WJZTV	13	23	BALTIMORE	MD	WHSW	24	39	BALTIMORE	MD
WBFF	45	27	BALTIMORE	MD	WNUVTV	54	40	BALTIMORE	MD
WMPB	67	28	BALTIMORE	MD	WIVQ	52	26	CUMBERLAND	MD
WLXV	65	15	CUMBERLAND	MD	WFPT	62	29	FREDERICK	MD
WHAGTV	25	16	HAGERSTOWN	MD	WWPB	31	21	HAGERSTOWN	MD
WJAL	68	22	HAGERSTOWN	MD	WGPT	36	16	OAKLAND	MD
WBOCTV	16	21	SALISBURY	MD	WCPB	28	05	SALISBURY	MD
WMDT	47	23	SALISBURY	MD	LM18	17	NONE	WASH (MD & VA	DC
LM19	18	NONE	WASH (MD & VA	DC	WRCTV	4	06	WASHINGTON	DC
WTTG	5	10	WASHINGTON	DC	WJLATV	7	12	WASHINGTON	DC
WUSA	9	16	WASHINGTON	DC	WDCATV	20	33	WASHINGTON	DC
WETATV	26	34	WASHINGTON	DC	LM20	30P	NONE	WASHINGTON	DC
WHMM	32	35	WASHINGTON	DC	LM22	36P	NONE	WASHINGTON	DC
WFTY	50	31	WASHINGTON	DC	WVVA	6	03	BLUEFIELD	WV
WCHSTV	8	06	CHARLESTON	WV	NU08	11	10	CHARLESTON	WV
WVAHTV	23	16	CHARLESTON	WV	WBOYTV	12	10	CLARKSBURG	WV
WLYJ	46	08	CLARKSBURG	WV	WSWPTV	9	12	GRANDVIEW	WV
WSAZTV	3	02	HUNTINGTON	WV	WOWKTV	13	07	HUNTINGTON	WV
WPBYTV	33	15	HUNTINGTON	WV	WNPBT	24	27	MORGANTOWN	WV
WOAYTV	4	05	OAK HILL	WV	WTAPT	15	09	PARKERSBURG	WV
WDTV	5	04	WESTON	WV	WTRFTV	7	06	WHEELING	WV
NU09	14	41	ARLINGTON	VA	WZXX	65	14	ASHLAND	VA
WCYBT	5	05	BRISTOL	VA	WVIRT	29	07	CHARLOTTESVIL	VA
WHTJ	41	09	CHARLOTTESVIL	VA	WNVC	56	15	FAIRFAX	VA
WRBV	69	13	FREDERICKSBUR	VA	WNV	53	38	GOLDVEIN	VA
WLFG	68	02	GRUNDY	VA	WVECTV	13	07	HAMPTON	VA
WHROTV	15	14	HAMPTON-NORFO	VA	WHSVTV	3	02	HARRISONBURG	VA
WSETTV	13	08	LYNCHBURG	VA	WJPR	21	04	LYNCHBURG	VA
WTKK	66	08	MANASSAS	VA	WMSYTV	52	08	MARION	VA
WTKC	55	16	NFLK-PTMTH-NW	VA	WTKRTV	3	02	NORFOLK	VA
WTVZ	33	19	NORFOLK	VA	WJCB	49	20	NORFOLK	VA
WSBNTV	47	04	NORTON	VA	WXEXTV	8	04	PETERSBURG	VA
WAVYTV	10	09	PORTSMOUTH	VA	WYAH	27	21	PORTSMOUTH	VA
WTVRTV	6	05	RICHMOND	VA	WWBT	12	11	RICHMOND	VA
WCVETV	23	15	RICHMOND	VA	WRLHTV	35	16	RICHMOND	VA
WCVW	57	19	RICHMOND	VA	WVRNTV	63	20	RICHMOND	VA
WDBJ	7	02	ROANOKE	VA	WSLSTV	10	11	ROANOKE	VA
WBRATV	15	16	ROANOKE	VA	WVFT	27	19	ROANOKE	VA
WEFC	38	20	ROANOKE	VA	WZZW	60	14	ROANOKE	VA
WPPT	51	06	STAUNTON	VA	WVBT	43	22	VIRGINIA BEAC	VA

\* Some stations had no call letters in the FCC data base, they were called "NEW". In this data base they are called NU## with unique numbers assigned each for purposes of identification. Similarly, the land mobile allocations are called LM##.

TABLE A1-3

## NUMBER OF STATIONS WITHIN CO-CHANNEL REUSE DIAMETER

<u>AREA</u>	<u>ZONE</u>	<u>NUMBER OF STATIONS</u>
Boston	1	46
Baltimore	1	48
Chicago	1	40
San Francisco	2	37
Los Angeles	2	33
Miami	3	48
Houston	3	37

- [1] Zenith Spectrum Compatible HDTV System, Zenith Electronics Corporation, 1000 Milwaukee Avenue, Glenview, IL 60025, Submitted to SS/WP1 of the FCC's Advisory Committee on ATV September 1, 1988
- [2] Hewlett-Packard HP-25 Applications Programs Revision B 7/75, published by Hewlett-Packard Company, 1975
- [3] Spectrum Allocation Studies, Station Separations and Desired to Undersired Ratios, PS/WP3-0051

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## APPENDIX 2

### INTRODUCTION

In this appendix, we will show that there is adequate spectrum within the existing VHF and UHF bands to provide every existing TV station 12 MHz of spectrum and in addition provide 48 MHz for additional uses. The 12 MHz for each tv station will be two 6 MHz blocks, one for transmitting a standard NTSC signal and one for transmitting a HDTV signal such as the Zenith Spectrum Compatible HDTV which has been described to the FCC's Advisory Committee on ATS. The additional spectrum for other uses is obtained by repacking the existing higher frequency TV channels so that the top 8 channels, 62 through 69, are vacated.

This analysis will concentrate on the existing TV stations in the most dense area of the nation, the northeast corridor where specific channel assignments will be developed for all of these stations. It will then be shown that the density in the other heavily populated areas of the USA is much less so that producing a repacking and HDTV channel assignment plan for the rest of the nation is highly likely.

The steps to be followed in this analysis are:

1. Reassign existing UHF TV stations to NTSC channels below channel 62 where they meet the NTSC to NTSC and Docket 18261 spacing criteria.
2. Make the additional 6 MHz HDTV channel assignments to all existing stations, which meet the HDTV to NTSC and HDTV to HDTV and Docket 18261 spacing criteria.
3. Show that the density of existing TV stations in the major metropolitan areas of the USA will likely permit such a plan to be produced in those areas also.

### DATA BASE

The same data base described in Appendix 1 was used for this analysis.

### ALGORITHM FOR CHANNEL ASSIGNMENT

The determination of the channels which an NTSC station could occupy was computerized in the following way. Spacing criteria for co-channel and first adjacent channel, were input into the program. Then the data base was scanned for each station under consideration and all channels 14 through 62 were tested to see if the spacing criteria were met.

Each channel for which the criteria was met was placed in a candidate data array.

Manual assignments were made from the candidate array which permit flexibility to optimize the assignment.

The spacing criteria used for reassignment of UHF NTSC stations are the same as the existing co-channel and first adjacent channel spacing required on the east coast, 155 and 55 miles respectively. The spacing to channels allocated for land mobile sharing in Docket 18261 is 212 miles and 110 miles for co-channel and adjacent channel respectively.

The existing taboos required for NTSC operation were not included as requirements in this reassignment analysis. It is felt that this step is well advised at this time in the light of the recent paper by Hitachi provided to working party 3 of the planning sub-committee of the FCC advisory committee on ATV. Hitachi showed that substantial improvements are possible in tuner performance, and they stated that they plan to sell an improved tuner in TV sets in the United States in early 1989.

All NTSC reassignments were made before any HDTV assignments were made. Then HDTV assignments of an additional 6 MHz channel were made using the procedure described in Appendix 1.

#### RESULTS OF ANALYSIS IN NORTHEAST CORRIDOR

Table A2-1 shows the NTSC stations in the northeast corridor, and the channel to which they can be reassigned while meeting the spacing requirement above, to free channels 62-69.

Table A2-2 shows all of the TV stations in the northeast corridor, the NTSC channel and the HDTV channel which meet the spacing requirements above. The median spacing of the HDTV channel from any other channel is 85 miles. The maximum channel number for HDTV assignments is channel 40. The channels shown for HDTV are one set which meet the spacing requirements. Numerous options exist for each assignment which could be chosen with due respect for other stations in the area.

Thus, we conclude that all existing TV stations in the northeast corridor can be repacked into existing 6 MHz channels 2 through 61, and in addition be given an additional 6 MHz HDTV channel.

#### EXTENSION TO THE ENTIRE USA

We conclude that having shown that the northeast corridor can be accommodated, it can likely be shown that the rest of the USA can be accommodated using the same techniques.

The comments in Appendix 1 apply here also. In addition, it may be desirable to phase in such a repacking in a few cities, or a few channels at a time. Therefore, the number of stations with higher channel numbers were investigated. Of interest was the number of existing TV stations which would need to change channel if the top N channels were allocated to a new service. Figure A2-1 shows the number of NTSC UHF stations in the data base on the top N channels in the entire USA as well as those stations within 155 miles of the cities designated.

The analysis described herein showed that 30 stations on the northeast corridor in Table A2-1 were required to change frequency to free up the top 8 channels. There are 25 stations in the top 8 channels, and there are 5 stations below the top 8 which were required to change frequency to make room for the 25 at the lower frequencies. Extrapolating this to the other cities, we find that approximately 5/25 or 20% more stations than those shown in Figure A2-1 would need to change frequency to free up the N channels shown.

TABLE A2-1

Existing stations on the northeast corridor and proposed new NTSC channel number to free channels 62-69.

<u>CALL</u>	<u>PRESENT CHANNEL NUMBER</u>	<u>PROPOSED NTSC CHANNEL NUMBER</u>	<u>LOCATION</u>
WOST	69	48	BLOCK ISLAND, RI
WFMZTV	69	26	ALLENTOWN, PA
WRBV	69	44	FREDERICKSBURG, VA
WQTV	68	42	BOSTON, MA
WSYT	68	26	SYRACUSE, NY
WHSE	68	27	NEWARK, NJ
WJAL	68	34	HAGERSTOWN, MD
WLFG	68	14	GRUNDY, VA
WHSI	67	51	SMITHTOWN, NY
WMPB	67	61	BALTIMORE, MD
WHSB	66	61	MARLBOROUGH, MA
WETG	66	15	ERIE, PA
NU07*	66	61	WEST MILFORD, NJ
WTKK	66	30	MANASSAS, VA
WEDY	65	33	NEW HAVEN, CT
WHSP	65	42	VINELAND, NJ
WLXV	65	28	CUMBERLAND, MD
WZXX	65	42	ASHLAND, VA
WNAC	64	34	PROVIDENCE, RI
WDPB	64	36	SEAFORD, DE
WVRN	63	39	RICHMOND, VA
WFPT	62	38	FREDERIC, MD
WTZA	62	42	KINGSTON, NY
WMFP	62	29	LAWRENCE, MA
NU02*	62	14	PRESQUE ISLAND, ME
WTGTV	61	46	WILMINGTON, DE
WTICTV	61	35	HARTFORD, CT
WGOT	60	47	MERRIMAC, NH
WVUW	51	60	PITTSFIELD, MA
WETATV	26	58	WASHINGTON, DC

\*These stations had no call letters in the FCC data base, they were simply called "New". They are called NU## for purposes of identification in this analysis.

TABLE A2-2

TELEVISION STATIONS ON THE NORTHEAST CORRIDOR WITH  
COMPUTED HDTV ASSIGNMENTS. EXISTING NTSC STATIONS  
REPACKED TO REMAIN BELOW CHANNEL 62. ALSO SHOWN  
ARE THE CHANNELS ALLOCATED TO LAND MOBILE IN DOCKET 18261

CALL*	CH	HDCH	TOWN	STATE	CALL*	CH	HDCH	TOWN	STATE
WCBB	10	11	AUGUSTA	ME	WLBZTV	2	03	BANGOR	ME
WABITV	5	04	BANGOR	ME	WVITV	7	08	BANGOR	ME
WMEATV	26	02	BIDDEFORD	ME	WMEDTV	13	11	CALAIS	ME
NU01	35	15	LEWISTON	ME	WMEBTV	12	09	ORONO	ME
WMTWTV	8	09	POLAND SPRING	ME	WCSHTV	6	05	PORTLAND	ME
WGMETV	13	12	PORTLAND	ME	WPXT	51	03	PORTLAND	ME
WAGMTV	8	09	PRESQUE ISLE	ME	WMENTV	10	11	PRESQUE ISLE	ME
NU02	14	02	PRESQUE ISLE	ME	WCAXTV	3	02	BURLINGTON	VT
WVNY	22	06	BURLINGTON	VT	WETK	33	07	BURLINGTON	VT
WNNETV	31	04	HARTFORD	VT	WVER	28	08	RUTLAND	VT
WVTB	20	04	ST. JOHNSBURY	VT	WVTA	41	05	WINDSOR	VT
WEDBTB	40	07	BERLIN	NH	WNHT	21	20	CONCORD	NH
WNDS	50	06	DERRY	NH	WENHTV	11	10	DURHAM	NH
WHEDTV	15	12	HANOVER	NH	WEKWTB	52	18	KEENE	NH
WLEDTV	49	10	LITTLETON	NH	WMURTV	9	17	MANCHESTER	NH
WGOT	47	22	MERRIMACK	NH	WCDC	19	07	ADAMS	MA
WGBHTV	2	03	BOSTON	MA	WBZTV	4	19	BOSTON	MA
WCVBTV	5	18	BOSTON	MA	WNEVTV	7	08	BOSTON	MA
LM01	14	NONE	BOSTON	MA	LM02	16	NONE	BOSTON	MA
WFXT	25	23	BOSTON	MA	WSBKTU	38	24	BOSTON	MA
WGBXTV	44	26	BOSTON	MA	WQTV	42	30	BOSTON	MA
WLVITV	56	35	CAMBRIDGE	MA	WLQF	32	28	GREENFIELD	MA
WMFP	29	32	LAWRENCE	MA	WHSB	61	31	MARLBOROUGH	MA
WLNE	6	09	NEW BEDFORD	MA	WFDG	28	20	NEW BEDFORD	MA
WRYT	46	39	NORWELL	MA	WVUW	60	04	PITTSFIELD	MA
WWLP	22	23	SPRINGFIELD	MA	WGGBTU	40	25	SPRINGFIELD	MA
WGBYTV	57	29	SPRINGFIELD	MA	WCVX	58	21	VINEYARD HAVE	MA
WHLL	27	33	WORCESTER	MA	WBCTTV	43	12	BRIDGEPORT	CT
WEDW	49	17	BRIDGEPORT	CT	WFSB	3	02	HARTFORD	CT
WHCTTV	18	05	HARTFORD	CT	WEDH	24	06	HARTFORD	CT
WTICTV	35	09	HARTFORD	CT	WVIT	30	11	NEW BRITAIN	CT
WTNH	8	10	NEW HAVEN	CT	WTVU	59	07	NEW HAVEN	CT
WEDY	33	27	NEW HAVEN	CT	WTWS	26	04	NEW LONDON	CT
WEDN	53	31	NORWICH	CT	WTXX	20	28	WATERBURY	CT
WOSTTV	48	21	BLOCK ISLAND	RI	WJAR	10	11	PROVIDENCE	RI
WPRITV	12	13	PROVIDENCE	RI	WSBETV	36	17	PROVIDENCE	RI
WNACTV	34	22	PROVIDENCE	RI	WTEN	10	09	ALBANY	NY
WNYT	13	12	ALBANY	NY	WXXATV	23	03	ALBANY	NY
WOCB	55	11	AMSTERDAM	NY	WBNGTV	12	11	BINGHAMTON	NY
WMGCTV	34	02	BINGHAMTON	NY	WICZTV	40	04	BINGHAMTON	NY
WSKGTU	46	07	BINGHAMTON	NY	WGRZTV	2	03	BUFFALO	NY
WIVBTV	4	05	BUFFALO	NY	WKBWTV	7	06	BUFFALO	NY
WNEDTV	17	09	BUFFALO	NY	WNEQTV	23	15	BUFFALO	NY
WUTV	29	16	BUFFALO	NY	WNYBTV	49	19	BUFFALO	NY
WVNYTV	7	08	CARTHAGE	NY	WETMTV	18	08	ELMIRA	NY
WENYTV	36	10	ELMIRA	NY	WLIW	21	18	GARDEN CITY	NY
NU03	52	16	ITHACA	NY	WNOD	26	08	JAMESTOWN	NY



<u>CALL*</u>	<u>CH</u>	<u>HDCH</u>	<u>TOWN</u>	<u>STATE</u>	<u>CALL*</u>	<u>CH</u>	<u>HDCH</u>	<u>TOWN</u>	<u>STATE</u>
WTZA	42	18	KINGSTON	NY	WCBSTV	2	03	NEW YORK	NY
WNBCTV	4	06	NEW YORK	NY	WNYW	5	26	NEW YORK	NY
WABCTV	7	22	NEW YORK	NY	WPIX	11	24	NEW YORK	NY
WNYETV	25	35	NEW YORK	NY	WNYCTV	31	36	NEW YORK	NY
WPTZ	5	04	NORTH POLE	NY	WNPITV	18	02	NORWOOD	NY
WCFETV	57	08	PLATTSBURGH	NY	WTBY	54	21	POUGHKEEPSIE	NY
WLG	55	29	RIVERHEAD	NY	WROCTV	8	11	ROCHESTER	NY
WHECTV	10	12	ROCHESTER	NY	WOKR	13	14	ROCHESTER	NY
WXXITV	21	15	ROCHESTER	NY	WUHF	31	16	ROCHESTER	NY
WRGB	6	05	SCHENECTADY	NY	WMHT	17	08	SCHENECTADY	NY
WMHX	45	22	SCHENECTADY	NY	WHSI	51	32	SMITHTOWN	NY
WSTMTV	3	06	SYRACUSE	NY	WTVH	5	18	SYRACUSE	NY
WIXT	9	17	SYRACUSE	NY	WCNYTV	24	13	SYRACUSE	NY
WSNRTV	43	19	SYRACUSE	NY	NU04	56	21	SYRACUSE	NY
WSYT	26	22	SYRACUSE	NY	WKTU	2	04	UTICA	NY
WUTR	20	12	UTICA	NY	WTUV	33	23	UTICA	NY
WNPETV	16	10	WATERTOWN	NY	WFFYTV	50	11	WATERTOWN	NY
WLVTTV	39	24	ALLENTOWN	PA	WFMZTV	26	25	ALLENTOWN	PA
WTAJTV	10	09	ALTOONA	PA	WWPCTV	23	11	ALTOONA	PA
WKBSTV	47	13	ALTOONA	PA	NU05	60	27	BETHLEHEM	PA
WPSXTV	3	02	CLEARFIELD	PA	WICUTV	12	11	ERIE	PA
WJETTV	24	02	ERIE	PA	WSEE	35	03	ERIE	PA
WQLN	54	04	ERIE	PA	WETG	15	05	ERIE	PA
WPCBTU	40	25	GREENSBURG	PA	WHPTV	21	05	HARRISBURG	PA
WHTMTV	27	06	HARRISBURG	PA	WITFTV	33	07	HARRISBURG	PA
WWLF	56	03	HAZLETON	PA	WJACTV	6	07	JOHNSTOWN	PA
WWCPTV	8	12	JOHNSTOWN	PA	WFATTV	19	21	JOHNSTOWN	PA
WGALTU	8	04	LANCASTER	PA	WLYHTV	15	16	LANCASTER	PA
WGGF	55	10	LEBANON	PA	KYWTU	3	02	PHILADELPHIA	PA
WPVITV	6	05	PHILADELPHIA	PA	WCAUTV	10	07	PHILADELPHIA	PA
WPHLTU	17	11	PHILADELPHIA	PA	LM08	19	NONE	PHILADELPHIA	PA
LM09	20	NONE	PHILADELPHIA	PA	WTAFTV	29	13	PHILADELPHIA	PA
WYBE	35	22	PHILADELPHIA	PA	WGBSTV	57	28	PHILADELPHIA	PA
KDKATV	2	03	PITTSBURGH	PA	WTAETV	4	05	PITTSBURGH	PA
WPXI	11	15	PITTSBURGH	PA	WQED	13	20	PITTSBURGH	PA
LM14	14	NONE	PITTSBURGH	PA	WQEX	16	10	PITTSBURGH	PA
LM15	18	NONE	PITTSBURGH	PA	WPRTTV	22	26	PITTSBURGH	PA
WPGHTV	53	27	PITTSBURGH	PA	WTVE	51	09	READING	PA
WGCBTV	49	30	RED LION	PA	WNEPTV	16	06	SCRANTON	PA
WYOU	22	08	SCRANTON	PA	WOLFTV	38	05	SCRANTON	PA
WVIATV	44	13	SCRANTON	PA	WXEK	29	04	STATE COLLEGE	PA
WBRETV	28	21	WILKES-BARRE	PA	WPMT	43	22	YORK	PA
WWACTV	53	09	ATLANTIC CITY	NJ	NU06	48	30	BURLINGTON	NJ
WNJS	23	04	CAMDEN	NJ	WNJUTV	47	38	LINDEN	NJ
WNJM	50	30	MONTCLAIR	NJ	WNJB	58	16	NEW BRUNSWICK	NJ
LM16	14	NONE	NEW YORK/NORT	NJ	LM17	15	NONE	NEW YORK/NORT	NJ
WNET	13	28	NEWARK	NJ	WHSE	27	33	NEWARK	NJ
WXTV	41	34	PATERSON	NJ	WWOR	9	23	SECAUCUS	NJ
WNJT	52	08	TRENTON	NJ	WLMR	59	24	VINELAND	NJ
WHSP	42	31	VINELAND	NJ	NU07	61	29	WEST MILFORD	NJ
WGMTV	40	08	WILDWOOD	NJ	WDPB	36	04	SEAFORD	DE
WHYYTV	12	21	WILMINGTON	DE	WTGITV	46	16	WILMINGTON	DE
WMPT	22	25	ANNAPOLIS	MD	WMARTV	2	03	BALTIMORE	MD